

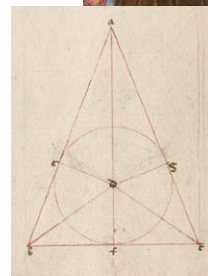
a brief history of formalism

from Aristotle to Alan Turing

From Formalism to Physicality, Alan Dix, UPC North, 30 April 2008

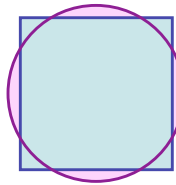
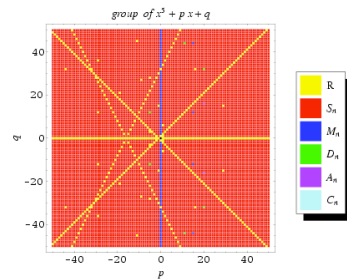
first steps

- Aristotle (384 BC - 322 BC)
 - foundations of logic
- Euclid (325 BC - 265 BC)
 - axiom, theorem and proof



breakthrough

- Evariste Galois (1811–1832)
 - solving the quintic
 - proving the impossible
 - formalising groups



I have not time.
I have not time.
I have not time.
I have not time.
I have not time.
I have not time.
I have not time.

babel grows

- Georg Cantor (1845–1918)
 - foundations of set theory
 - mathematics of the infinite

1/1	2/1	3/1	4/1	5/1	6/1	...
1/2	2/2	3/2	4/2	5/2	6/2	...
1/3	2/3	3/3	4/3	5/3	6/3	...
1/4	2/4	3/4	4/4	5/4	6/4	...
1/5	2/5	3/5	4/5	5/5	6/5	...
1/6	2/6	3/6	4/6	5/6	6/6	...
...	...	...	...	...	...	...

- James Clerk Maxwell (1831–1879)
 - Maxwell's equations
 - unifying electricity and magnetism
 - the theory of everything

$$\nabla \cdot \mathbf{E} = \frac{\rho}{\epsilon_0}$$

$$\nabla \times \mathbf{E} = -\frac{\partial \mathbf{B}}{\partial t}$$

$$\nabla \cdot \mathbf{B} = 0$$

$$\nabla \times \mathbf{B} = \mu_0 \mathbf{J} + \epsilon_0 \mu_0 \frac{\partial \mathbf{E}}{\partial t}$$

the cracks form

- self-reference

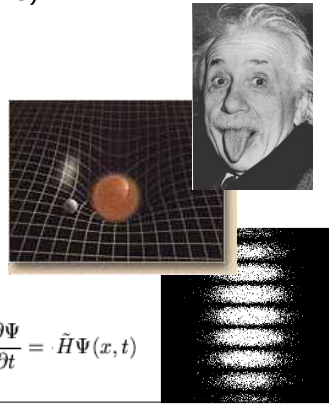
- all Cretans are liars
Epimenides the Cretan (6th century BC)
- the Russell Paradox
 - the set that doesn't contain itself
$$\{ X \mid X \notin X \}$$

The next line is true.
The last line was false.

- uncertainty at the centre

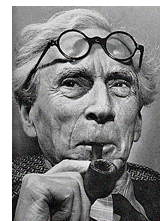
- Einstein's relativity
- quantum mechanics

$$i\hbar \frac{\partial \Psi}{\partial t} = \hat{H} \Psi(x, t)$$



battling on

- Bertrand Russell (1872–1970)
 - Principia Mathematica
(with Whitehead)
 - reducing mathematics to logic
 - the proof of all things

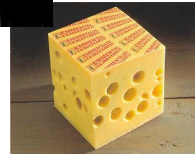


the end comes

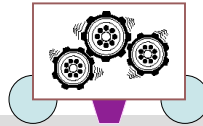
- Kurt Gödel (1906–1978)
 - incompleteness theorem
 - mathematics is full of holes



this statement
cannot be proved



- Alan Turing (1912–1954)
 - formal foundations of computation
 - inherent limitations of computation



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... but

- I still expect my change
to add up at the supermarket

